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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/594,284	09/26/2006	Andre Witzmann	3839	6105

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EXAMINER	
HORNING, JOEL G	
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1712	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/594,284	WITZMANN ET AL.	
	Examiner	Art Unit	
	JOEL HORNING	1712	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *26 July 2011*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *2-6,8,17-19 and 21-27* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *2-6,8,17-19 and 21-27* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

1. **Claims 22, 23, 26 and 27** are rejected under 35 U.S.C. 103(a) as being unpatentable over Recasens et al (US 3837870) in view of Wang et al (Applied Surface Science **221** (2004) 293-301) in view of Li (WO 95/35269, as previously supplied by applicant).

   Recasens et al is directed towards the formation of refractory bricks (zirconium containing bricks), specifically ones to be used in glass furnaces (abstract) because of its high resistance to corrosion by molten glass (when the bricks are placed in contact with a glass melt during processing of the glass melt in the furnace). Its composition comprises alumina, silica, zirconia and chromium oxide and produces a vitreous phase (col 1, lines 29-40), Recasens et al further

teaches that the inclusion of zirconia into the refractory adds plasticity to the composition which reduces cracking in the resulting refractory bricks (col 3, lines 19-30).

Wang et al is directed towards a process for treating the surface of refractory bricks which, like Recasens et al, also comprises alumina, silica and zirconia (abstract). These bricks are, like Recasens, to be used as linings for furnaces which will be in contact with molten glassy material (slag). Wang et al, also like Recasens, recognizes that ingress of the glassy material into the refractory bricks causes corrosion and erosion of the refractory, which is undesirable. In order to solve this problem, Wang et al teaches eliminating cracks and porosity from the surface of the refractory, sealing it (Introduction). This is performed by exposing the refractory surface to CO_2 laser radiation, which seals the surface (closed) porosity and can result in a crack-free, dense laser treated layer on the refractory (abstract). The resulting layer structure is taught to have no apparent cracks or flaws, it is closed (section 3.2).

Thus it would have been obvious to a person of ordinary skill in the art at the time of invention to treat the refractory composition of Recasens et al by a laser treatment process as suggested by Wang et al: closing the porosity in a surface layer of the refractory in order to improve its corrosion resistance to molten glass, which the refractory would be in contact with when used in the intended glass furnace of Recasens et al.

Regarding the limitation that the laser treatment layer of the refractory be vitreous, it is not clear from Recasens and Wang whether the produced structure would be vitreous.

Li is also directed towards a process of laser treating bricks (abstract) with similar constituents (page 1) in order to seal their porosity so as to solve the same problem of how to protect brick surfaces from harsh environments: to produce a "protective, impermeable coating for use in a chemical … plant" (page 2, paragraph 7). Li further teaches that the bricks so sealed (closed surface without apparent cracks or flaws) can have an amorphous (vitreous) surface which is used to protect the underlying material of the brick (page 3, paragraphs 3-4). The examiner notes that Li teaches accomplishing this using a CO_2 laser (page 3, ¶8) operated at low power densities, such as 2-2.5 W/mm^2 (page 4, ¶2), which overlaps with applicant's taught energy levels for the laser.

Thus it would have been obvious to a person of ordinary skill in the art at the time of invention to perform the laser treatment in the process of Recasens in view of Want in the manner taught by Li so that the treated surface is vitreous because it was a known structure for laser treated bricks to develop and was known to be useful for protecting the underlying brick material from degradation in a chemical process (e.g. glass slag contact).

Since the refractory material is what is modified by the laser to produce the closed layer, the closed layer will contain materials from the refractory material. Tempering is not required by the process.

Furthermore, since the intent of Recasens et al is to use the refractory in glass furnaces where they are in contact with a glass melt, it is obvious to process a glass melt with it in contact with the closed vitreous layer of the refractory of Recasens et al in view of Wang et al **(claim 22)**.

Regarding **claim 23**, the additional step of spraying the surface with a powder or solution is not required.

2. Regarding **claims 26 and 27**, Li does not teach that any of the brick material is removed during the laser processing. When a reference discloses the limitations of a claim except for a property, and the Examiner cannot determine if the reference inherently possesses that property (in this case, that no brick material is removed during the process), the burden is shifted to Applicant(s). In re Fitzgerald, USPQ 594 and MPEP §2112.

Regarding whether applicant would expect the laser treatment of the bricks to remove material, as noted above Li teaches accomplishing the laser sealing process using a CO_2 laser (page 3, ¶8) operated at low power densities, such as 2-2.5 W/mm^2 with scan rates of 1-200mm/sec (page 4, ¶2). Li does not teach what the beam diameter should be. However, Wang teaches using a beam diameter of 4mm and a scanning velocity of 4-12mm/s (which overlaps with applicant's claimed values) (section 2). Thus it would have been obvious to a person of ordinary skill in the art at the time of invention to perform the laser sealing process as described in Li on the bricks with a beam diameter of 4mm since it was taught to be appropriate conditions when sealing these bricks using a CO_2 laser.

On page 3, lines 15-19 of applicant's specification, applicant teaches that under these conditions the result will be "a closed, vitreous layer on the surface of the refractory material, without any material having been removed." Thus by performing the laser sealing process under normal known conditions of the prior art the applicant teaches that no material will be removed.

Li teaches that contamination might be removed during the laser treatment (page 3, ¶5), however, it would have certainly have been obvious to a person of ordinary skill in the art at the time of invention to perform the process on a brick that had no contamination because contamination (by definition) is not desired to be present.

3. **Claims (2-6)/17, 17-19, 21 and 25** are rejected under 35 U.S.C. 103(a) as being unpatentable over Recasens et al (US 3837870) in view of Wang et al (Applied Surface Science **221** (2004) 293-301) in view of Li (WO 95/35269, as previously supplied by applicant) as applied to claim 22, further in view of Torok et al (US 3360353) as evidenced by Triantafyllidis et al (Applied Surface Science 186(2002) 140-144).

Recasens et al in view of Wang et al in view of Li does not teach using their treated refractory bricks suitable for use in a glass furnace specifically in a Danner blowpipe section of a glass furnace.

However, Torok teaches a furnace and method for producing glass wherein molten glass is in contact with a refractory coated mandrel during the process (abstract) and the mandrel can be a Danner blowpipe (col 1, lines 45-60). Torok

teaches that the refractory material on the mandrel is formed of several uniform diameter segments, which can be considered bricks (col 3, lines 68-75). Torok further teaches that the refractory bricks of the Danner blowpipe erode as the molten glass is in contact, forming glass tubing. This causes defects in the produced glass tubing which necessitates replacing the refractory material in a time consuming process (col 1, line 62 through col 2, line 14).

Thus it would have been obvious to a person of ordinary skill in the art at the time of invention to use the laser treated refractory bricks of Recasens et al in view of Wang et al in view of Li in the Danner blowpipe and glassmaking process of Torok since they were refractory bricks suitable for such furnaces and it would reduce the erosion of the refractory bricks, allowing the production of longer sections of high quality pipe and increase the period between time consuming replacements of the refractory bricks of the blowpipe

Tempering is not required by the claim **(claim 17)**.

4. Regarding **claim 2/17**, Wang et al teaches that alpha alumina and metastable zirconia melt during their process and both melting temperatures are above 2000°C, within the claimed range, so the refractory is heated to temperatures within this range (section 4.2).

5. Regarding **claim (4-5)/17,** Wang teaches using a beam diameter of 4mm and a scanning velocity of 4-12mm/s (which overlaps with applicant's claimed values) (section 2), so that the exposure time is ~0.33-1 second.

6. Regarding **claims (3-5)/17**, Wang et al teaches that the power, beam diameter and the beam scanning rate are operating parameters (from these parameters, the power density and the exposure time can be determined, so they are equally known as operating parameters), which are all result effective variables for controlling the smoothness and surface cracking in the resulting laser treated surface (section 2 and section 3.1). Likewise, Li teaches that appropriate energy levels for the laser in order to seal these surfaces is 2-2.5W/mm^2, which lies within applicant's claimed ranges with scanning rates that overlap with applicant's claimed range (page 4, ¶2-3).

Thus, it would have been obvious to one of ordinary skill in the art at the time of invention to choose the instantly claimed ranges of "a power density of 2 to 4W/mm^2" **(claim 3/17)**, "an effective exposure time of 0.1 to 5 s" **(claim 4/17)**, "a scan rate of 1-10 mm/s" and a laser beam "diameter of 2-5 mm" **(claim 5/17)** through process optimization, since it has been held that when the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. See In re Boesch, 205 USPQ 215 (CCPA 1980).

Thus it would have been obvious to a person of ordinary skill in the art at the time of invention to choose a power density of 2 to 2.5W/mm^2 since Li teaches that power range to be effective at sealing brick surfaces and producing glassy surfaces **(claim 3/17).**

7. Regarding **claim 6/17**, Triantafyllidis et al teaches that CO_2 lasers have a wavelength of 10.6 microns (page 141, section 2), which is within applicant's claimed range.

8. Regarding **claim 18,** from figure 3b of Wang et al, the surface layer is shown to be more than 100 microns but not more than 1000 microns, which is within applicant's claimed range.

9. Regarding **claim 19**, since the refractory material is what is modified by the laser to produce the closed layer, the closed layer will contain materials from the refractory, including aluminum and zirconium.

10. Regarding **claim 21**, since the laser treatment is performed on the refractory bricks that are later placed into the Danner blowpipe which is then used in contact with a glass melt, the laser treatment to produce the closed vitreous layer is clearly performed before contact with the glass melt.

11. **Claim 25** is rejected for the same reasons claims 26 and 27 were previously, but now in view of the current rejection.

12. **Claims 8, (2-6)/8 and 24** are rejected under 35 U.S.C. 103(a) as being unpatentable over Recasens et al (US 3837870) in view of Wang et al (Applied Surface Science **221** (2004) 293-301) in view of Li (WO 95/35269, as previously supplied by applicant), further in view of Torok et al (US 3360353) as applied to claim 17 above, further in view of Petitbon (US 4814575). Claim 8 further requires that the surface be sprayed with a powder or a solution before or during the laser treatment or that the

ceramic body be infiltrated with a solution that includes zirconium or aluminum containing compounds.

Recasens et al in view of Wang et al in view of Li in view of Torok et al is directed towards methods of laser treating ceramic bodies so that the amount of porosity on the surface of the refractory is decreased, which improves the corrosion and spalling resistance of the refractory. Li further teaches coating the surface prior to the laser treatment with a solution of refractory material, so that is forms part of the sealed surface of the brick. It teaches using materials which are present in the bricks in the coating, such as siliceous materials (page 3 ¶4), but it does not specifically teach including components that contain aluminum or zirconium.

However, Petitbon is also directed towards methods of laser treating ceramic bodies so that their surface porosity is reduced. It teaches that by spraying a ceramic powder onto the substrate during the laser treatment, so that the powder and substrate surface melt, the molten powder particles will fill available surface porosity, thus reducing the presence of porosity or microcracks on the substrate surface, improving the microstructure and improving the properties (thermal expansion coefficient, residual stress, etc) of the surface (col 2, line 40 through col 3, line 13). It teaches using the materials present in the substrate as the powder sprayed onto the substrate, such as when the substrate is zirconia or alumina based using zirconia or alumina powder to fill the cracks in the substrate (col 4, lines 30-35).

Thus it would have been obvious to a person of ordinary skill in the art at the time of invention performing the process of Recasens et al in view of Wang et al in view of Torok et al to spray a powder or solution of material that is present in the substrate, such as aluminum or zirconium, at the substrate so that they melt together during laser treatment in order to fill surface porosity or microcracks that may be present in the final surface, thus increasing the corrosion and spalling resistance as well as other properties of the substrate **(claim 8)**.

13. **Claims (2-6)/8** are rejected for the same reasons they were previously, but now in view of Petitbon.

14. **Claim 24** is rejected for the same reasons claims 26 and 27 were previously, but now in view of the current rejection.

Response to Arguments

15. Applicant's arguments filed 07-26-2011 have been fully considered but they are not persuasive. Nevertheless, in view of better art, the examiner has made a new rejection to more clearly show that forming a vitreous surface by laser treating the brick was obvious at the time of invention.

16. Regarding sections A and B the rejection has been changed with Li specifically teaching these features, so these arguments are not convincing. Particularly, as taught by Li applicant's power densities were specifically known from the prior art to be effective for producing vitreous sealed brick surfaces and are expected to not remove material when contaminants are not present.

17. Regarding section C, Wang was available to the public electronically 13 September 2003 and was published in paper form 15 January 2004. For both dates the art is available under 102(b). Perfecting foreign priority will not overcome the reference. The examiner has included a new copy of the Wang reference with verification of these dates on the last page of the document.

18. Regarding section D, most of the arguments are not relevant due to the new rejection. However, on page 21, applicant argues that a practitioner would not combine the teaching of Recasens and Wang because Recasens is directed towards the refractory materials for casting of molten glass while Wang is directed towards refractory materials for the casting of molten metals. However, they are both directed towards the same field of refractories materials for casting high temperature molten materials. Additionally, they are directed towards the same problem, which is also applicant's problem, of how to deal with the corrosion of refractory materials by molten glass (slag is molten glass material). Thus they are analogous art and a practitioner is particularly motivated to use the techniques known in either to mitigate this glass corrosion problem. Though applicant suggests that the refractory requirements for Recasens and Wang are very different, the examiner notes that they use the same kinds of refractorys (i.e. those claimed by applicant).

19. Regarding section III, Li teaches using the power densities claimed by applicant, so this argument that a practitioner would not use them is not convincing in view of the new rejection.

20. Regarding section IV, applicant argues that the materials of Petitbon are entirely different than those present in claim 8. Petitbon does not need to teach the same materials. Petitbon teaches how to improve the corrosion resistance of refractories, it does that. Regarding the power levels applicant mentions that Petitbon uses. The examiner is not suggesting using those power levels, only the technique. The power levels chosen would be those appropriate to the refractory itself. According to Li, applicant's claimed power levels are appropriate for incorporating a coating material into the brick glazing.

21. Regarding applicant's suggestion that the combination of teachings would use higher laser powers which would cause evaporation of materials which would cause cracking and undesirable effects. Li is being used to teach what power levels would be appropriate and form a closed vitreous surface.

Conclusion

22. No current claims are allowed.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to JOEL HORNING whose telephone number is (571)270-5357. The examiner can normally be reached on M-F 9-5pm with alternating Fridays off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael B. Cleveland can be reached on (571)272-1418. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/J. G. H./
Examiner, Art Unit 1712

/David Turocy/
Primary Examiner, Art Unit 1717